

A New Subspecies of *Darevskia raddei* (Boettger, 1892) (Sauria: Lacertidae) from the West Azerbaijan Province, Iran

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Abstract Based on extensive field work in the northern Zagros Mountains, a new subspecies of *Darevskia raddei* (Boettger, 1892) from the west Azerbaijan Province, northwestern Iran is described. The new subspecies is distinguishable from all the other three subspecies of *D. raddei* based on the combination of several distinguishing characters, such as dorsal body with 50–55 oval to round, smooth, or very weakly keeled, scales, 25–31 scales across the gular region, 18–20 femoral pores on each side of body (reaching the knee), 29–31 tuberculate lamellae under the fourth toe, 11–12 supraciliaries, 9–11 collars and a specific color pattern. The new subspecies meets all the morphological characters described by Eiselt *et al.* (1993) for an undefined and intermediate form between *D. raddei* in the east of and *D. r. vanensis* in the west of the distribution range of the species.

Keywords Lacertidae, *Darevskia raddei chaldoranensis*, new subspecies, Zagros Mountains, West Azerbaijan, Iran

1. Introduction

The genus *Darevskia* Arribas, 1997 consists of 27–28 species distributed from the Caucasus region (Armenia, Azerbaijan, Georgia, extreme southwestern Russia), Crimea (part of Ukraine), and north and east Asiatic Turkey, eastwards to the Elburz Mountains of Iran and to the Kopet Dag Mountains on the Iran-Turkmenistan border (Anderson, 1999). One of the species (*D. praticola*) extends into the eastern Balkan Peninsula, and *D. mostoufi* (Baloutch, 1976) is known only from the Dasht-e Lut in Baluchistan, though the identity and locality for this species have raised questions by In Den Bosch (1999), Anderson (1999) and others (e. g., Arnold *et al.*, 2007; Rastegar-Pouyani *et al.*, 2007, 2008a; Sindaco and Jeremcenco, 2008).

Arribas (1997), based on morphological and anatomical characters, proposed a new generic name,

Darevskia, for a group of small-sized taxa of lacertids (snout vent length = 50–85 mm) belonging to the tribe Lacertini, which were previously considered belonging to the inclusive genus *Lacerta* Linnaeus, 1758. Arribas (1997) and Arnold *et al.* (2007) discussed in details the anatomical and morphological description of the genus *Darevskia*. One of its species is *D. raddei* (Boettger, 1892) distributed in northwestern Iran, eastern Turkey, and southern and northern Armenia with three distinct subspecies: *D. raddei raddei* (Boettger, 1892), *D. r. nairensis* (Darevsky, 1967) and *D. r. vanensis* (Eiselt *et al.*, 1993).

In this paper we describe a new subspecies of *D. raddei* (Boettger, 1892). It occurs in Chaldoran area, west Azerbaijan Province at an elevation of about 1940 m in extremely northwestern Iran (Figure 1).

2. Material and Methods

During field work investigating the herpetofauna of northwestern regions of the Iranian Plateau, on 07 July 2007, five specimens of *Darevskia raddei* ssp. nov. (including three adults and two subadults) were collected at a locality

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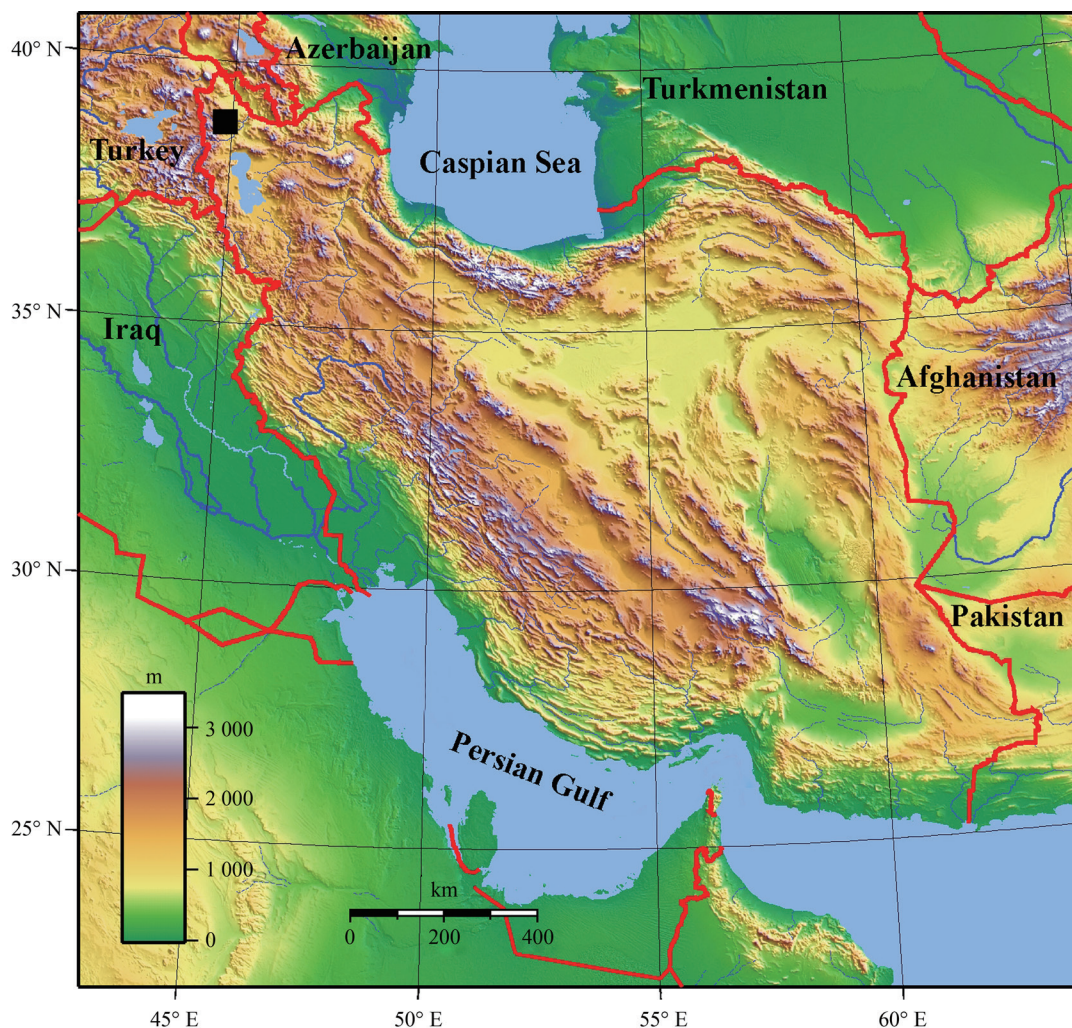


Figure 1 The type locality for *Darevskia raddei chaldoranensis* ssp. nov., 20 km southwest of the Shut Village, the Chaldoran area, west Azerbaijan Province, northwestern Iran (39° 03' N, 44° 22' E) (about 1940 m above sea level).

20 km southwest of Shut (near the road between Siah Cheshmeh and Shut) in the Chaldoran area (39° 03' N, 44° 22' E) in northern regions of west Azerbaijan Province, Iran, at about 1940 m above sea level. All the specimens were anaesthetized with ether, fixed with 96% ethanol and later kept in 70% ethanol, and they are deposited in the Razi University Zoological Museum (RUZM). Morphometric measurements were taken by digital calipers to the nearest 0.01 mm, including snout vent length (SVL), tail length (TL), head length (HL), head width (HW), length of forelimb (LFL) and length of hind limb (LHL), and then scaled photos were taken using a Dino-Lite model AM313.

3. Results

***Darevskia raddei chaldoranensis* ssp. nov. (Figures 2–3)**
Holotype and type locality: An adult male (Museum

number: RUZM- LL70.1) collected by the authors on 07 June 2007 from the Chaldoran area (39° 03' N, 44° 22' E) in the northern regions of west Azerbaijan Province, Iran.



Figure 2 Dorsal view of male holotype (RUZM- LL70.1) and female paratype (RUZMLL70.4) of *Darevskia raddei chaldoranensis* ssp. nov.

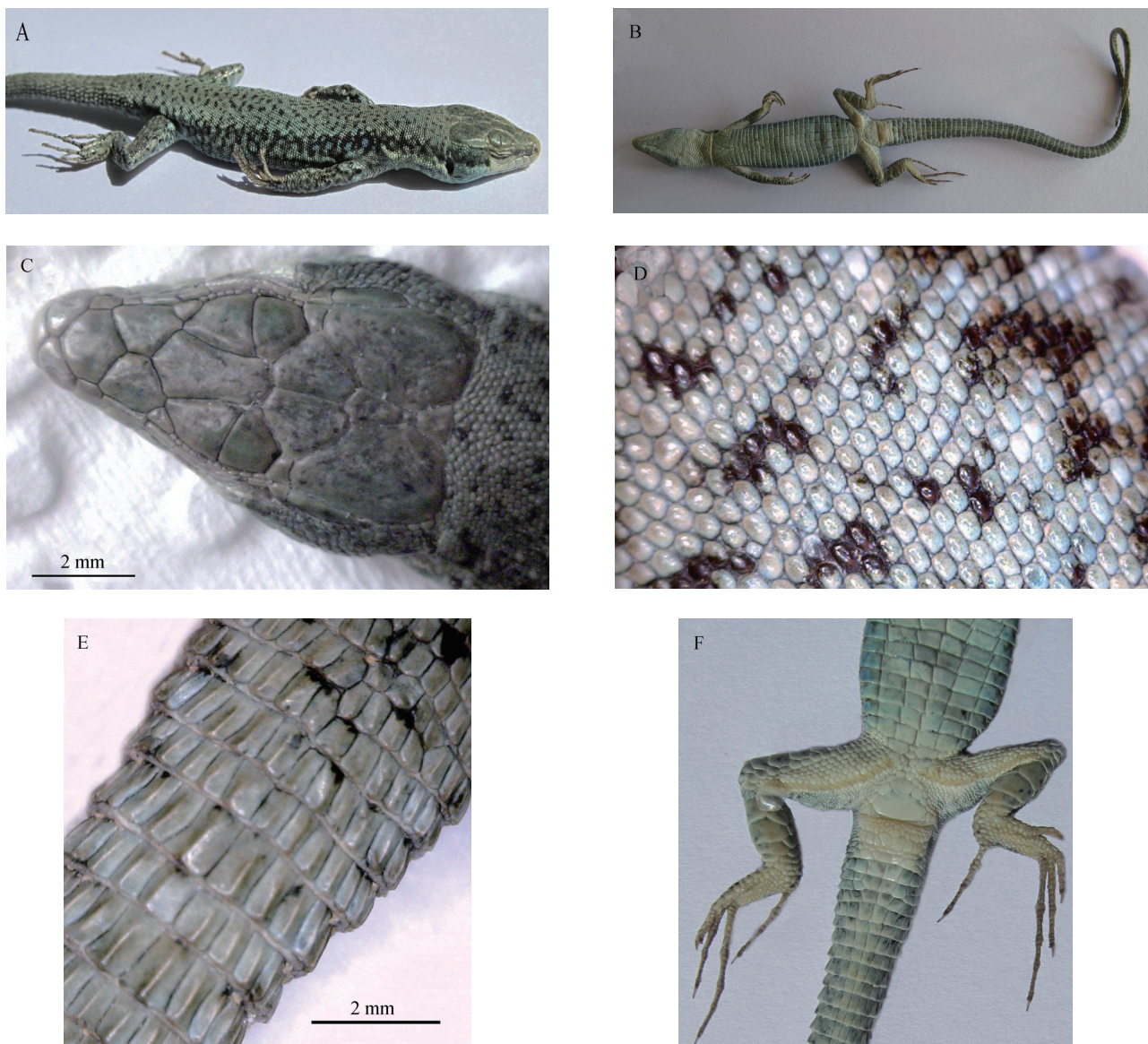


Figure 3 *Darevskia raddei chaldoranensis* ssp. nov.: A: lateral view; B: ventral view with only six longitudinal rows of plates; C: upper head with 11/12 granular scales; D: mid-dorsal scales; E: strongly keeled upper caudal scales; F: posterior ventral regions (Note the enlarged preanal plate and developed femoral pores).

Paratypes: Four specimens: an adult male (RUZM-LL70.2), an adult female (RUZM-LL70.4) and two sub-adults (RUZM-LL70.3 and RUZM-LL70.5).

Diagnosis: A relatively small-sized lacertid, maximum SVL = 50–52 mm, TL = 102–110 mm; dorsal body with 50–55 smooth, or very weakly keeled, juxtaposed dorsal scales, not imbricated; ventral body with six longitudinal and 28–31 transverse rows of scales; 25–28 gulars on midline from the level of the third pair of chin shields to collar; 10–12 granules between supraciliaries and supraoculars; collar weakly serrated, consisting of 9–11 scales; 29–30 lamellae present under the fourth toe; and 20–20

femoral pores.

Description of the holotype: A lacertid lizard belonging to *Darevskia raddei* (Boettger, 1892) with a combination of the following characteristics: transverse series of ventral plates with rectilinear or nearly rectilinear posterior margins in six longitudinal series; single postnasal; parietal foramen present; collar weakly serrated, consisting of 9–11 scales, with two middleones being the largest; preanal plate large, bordered by a semi-circle, consisting of 7–8 scales; granules between the large preanal plate and anal cleft absent; masseteric plate present; temporal plate present. It is distinguishable from other species of

the genus *Darevskia* with a combination of the following characters: body slightly slender; head length 1.6 times of its width and 24% of snout vent length; limbs slender, length of hind limbs about 2.27 times of head length, and 1.65 times of forelimb length; tail length about 2.11 times of snout vent length; paired supranasals meeting behind rostral, not connecting to frontonasals; frontal distance equal to the distance from its anterior border to tip of snout, frontal maximum width about half of its length, narrowed posteriorly where its width is about 2.7 times of its length; frontoparietal about 2/3 of the length of frontal with an extensive common suture, each frontoparietal in contact with frontal, the third and fourth supraoculars, parietal and interparietal; parietals longer than broad (1.63 times); interparietal lozenge-shaped, about half of the length of frontal, not connected to occipital, separated from it by a small scale; interparietal surrounded by parietals, frontoparietals, and a small roundish scale, with a clear parietal foramen; occipital more than half of the length of interparietal, surrounded by a small roundish scale anteriorly, parietals laterally arranged, and 6–7 granular scales present posteriorly; four supraoculars on each side, the first one in contact with prefrontal and loreal, the first supraciliaries, and first supraciliary granule, 7/7 supraciliaries, the largest, keeled, and broadly in contact with the first supraocular; nostril bordered posteriorly by a single postnasal, anteriorly and dorsally by supranasal, and inferiorly by the first supralabial; two loreals, with the second being much larger than the first, longer than high, and strongly keeled; six supralabials present, with four of them being anterior to subocular which contacts mouth; subocular longer than high; six infralabials, with the sixth being the largest; mental roundish anteriorly and in contact with the first infralabial and the first pair of submaxillary shields, which are found in five pairs, with the first pair being the smallest and in contact with mental, and the first and second infralabials; scales of the first two pairs of submaxillary shields entirely in contact, the third pair partly separated by a long gular scale, the last two pairs broadly separated, the third being the largest; eyelid not serrated, scales in lateral region of lower eyelid enlarged; temporal region with about 85–90 scales on each side; six supratemporals on each side, with the first being over 5 times longer than the second and in contact with parietal; tympanum vertically elliptical, a little longer than wide; a clear gular fold present; mid-dorsal scales not imbricated, weakly keeled; scales on flanks almost in the same size, 50–55 dorsal scales across the widest part of dorsal body; a transverse row with 32–34 scales on each dorsal hind limb; 145–150 dorsal scales arranged in a single longitudi-

nal row from occipital to the first tail ring; six longitudinal rows of ventral plates, 28–29 transverse series of ventrals between the collar and hind limbs; preanal region covered by an enlarged plate, broader than long, and surrounded by eight scales, with the median scale being the largest; dorsal surfaces of upper forelimbs covered by large, imbricated plates that extend onto anterior and dorsal surfaces of lower limbs; fingers weakly denticulate, dorsal surface of the first finger longitudinally covered by four scales and the fourth finger by 15 scales, lower surface of the first finger covered by 12 scales, and the fourth finger ventrally by 22 scales, anterior surface of thigh covered with a row of very large, imbricated scales ventrally, and with small granular scales dorsally; 20–20 femoral pores, reaching knee and medially separated from each other by 3–4 scales; upper surface of tibia covered with small granular scales, ventral surface of tibia by a longitudinal row of enlarged, smooth, imbricated plates; dorsal surface of the first toe longitudinally covered by a row of 12 scales, and the fourth toe by a row of 18 scales, lower surfaces of the first toe covered by a row of 12 scales, 29–30 lamellae present under the fourth toe; upper caudal scales much larger than posterior dorsals, obtusely pointed and mucronate, with strong keels that form straight lines along tail; 25 scales on the fifth whorl behind vent; 114–116 rings present throughout the tail.

Coloration and color pattern (in life and preservation):

Upper surface of head greenish-olive; temporal region dark green superiorly and light green inferiorly; background color of dorsum brownish-olive with a combination of numerous dark brown spots; dorsolateral region bearing numerous dark brown spots with bluish-white ocelli, the dark brown spots having tendency to form a dorsolateral dark band; upper surface of limbs with dark brown and white spots; ventral body greenish, plantar, and palmar regions yellowish-cream; upper surface of tail greenish anteriorly, olivish-brown posteriorly. In the genus *Darevskia*, little sexual dimorphism occurs in coloration, with a basic dorsal pattern consisting of longitudinal streaks or bands, and flanks may be reticulated (Arnold *et al.*, 2007). In the new subspecies, the coloration and color pattern of the type series (the holotype and paratypes) are essentially very similar except that the lateral regions of males are darker than those of females.

Measurements: The measurements for holotype (RUZM-L70.1) were made as: SVL = 52.13 mm, TL = 110.2 mm, HL = 12.72 mm, WH = 7.9 mm, LFL = 17.5 mm, and LHL = 28.95 mm.

Description of the paratypes: The paratypes, four

specimens, one adult male (RUZM- LL70.2), one adult female (RUZM- LL70.4), and two subadults (RUZM- LL70.3 and RUZM- LL70.5) are essentially similar to the holotype, with the only differences in the following characters: dorsal scales 50–55 across middle body; ventral plates arranged in 28–31 transverse rows from collar to hind limbs; head length of the adult male 1.79 times of its width and 25% of snout vent length; head length of the adult female 1.71 times of its width and 23% of snout vent length; head length of the two subadult specimens 1.66 times of its width and 15% of snout vent length; tail length of the adult male about 2.03 times of snout vent length; the adult female with an incomplete tail; mean tail length of subadult specimens about 1.85 times of snout vent length; 17–20 femoral pores, and 4–6 supratemporals present.

Coloration: The coloration and color pattern of the paratypes are essentially similar to those of the holotype, except that the lateral regions of the paratypes are not as dark as those of the holotype.

Measurements of paratypes: The measurements of the two adults and two subadults are made as: of the adult male (RUZM- LL70.2), SVL = 50.48 mm, HL = 12.92 mm, HW = 7.22 mm, LFL = 18.44 mm, LHL = 28.2 mm, TL = 102.52 mm; of the adult female (RUZM- LL70.4), SVL = 48.66 mm, HL = 11.51 mm; HW = 6.7 mm, LFL = 18.11 mm, LHL = 26.3 mm, tail being regenerated; of the subadults (RUZM- LL70.3 and RUZM- LL70.5), SVL = 38.03 mm, HL = 9.35 mm, HW = 5.62 mm, LFL = 12.44 mm, LHL = 20.15 mm, and TL = 70.3 mm on average.

Comparison: *Darevskia raddei chaldoranensis* ssp. nov. is different from the other three subspecies of *Darevskia raddei* (Boettger, 1892) based on those distinguishing characters as follows (Table 1): 1) the size (50–53 mm) of *D. r. chaldoranensis* ssp. nov. is smaller than (63–69 mm) that of *D. raddei raddei* (Boettger, 1892), and the former obviously differs from the latter in coloration and color pattern (Boettger, 1892; Baran and Atatür, 1998; Anderson, 1999); 2) the size of the new subspecies is smaller than (67 mm) that of *D. r. nairensis* (Darevsky, 1967), and the former has more dorsal scales (50–55) than the latter (52), more granules in a longitudinal row between supraciliaries and supraoculars (10–12) than the latter (8–9), and more supratemporal plates (6) than the latter (4–5), and the two differ in coloration and color pattern (Darevsky, 1967; Eiselt *et al.*, 1993; Eiselt, 1995); and 3) the size (50–53 mm) of the new subspecies is smaller than that (63 mm) of *D. r. vanensis* (holotype) (Eiselt *et al.*, 1993), and the former has more dorsal scales (50–55) than

the latter (44), fewer granules (10–12) in a longitudinal row between supraciliaries and supraoculars than the latter (15), and fewer supratemporal plates (6) than the latter (5), and the two also differ in coloration and color pattern (Eiselt *et al.*, 1993; Anderson, 1999).

The new subspecies differs from *D. r. vanensis* (Eiselt *et al.*, 1993) in having a smaller size (50–53 mm vs. 63 mm in *D. r. vanensis* holotype); higher count of the dorsal scales (50–55 vs. 44 in *D. r. vanensis*); lower count of the granules in a longitudinal row between supraciliaries and supraoculars (10–12 vs. 15 in *D. r. vanensis*); supratemporal plates (6 vs. 5 in *D. r. vanensis*) and differences in coloration and color pattern (Eiselt *et al.*, 1993; Anderson, 1999).

Habitat: The type locality of *D. r. chaldoranensis* ssp. nov. is located in a steppe and rocky area in the northern Zagros Mountains, about 20 km southwest of Shut (near the road from Siah Cheshmeh to Shut) in the Chaldoran area (39° 03' N, 44° 22' E) in the northern regions of west Azerbaijan Province, Iran with an elevation of about 1940 m (Figure 4). The vegetation of the area is characterized by the plants including *Amygalus* spp., *Crataegus aronia*, and *Artemisia* spp., The new subspecies, *D. r. chaldoranensis* was found sympatric with *Laudakia caucasia* and *Ophisops elegans*.

Etymology: *Darevskia r. chaldoranensis* is so named as it was collected for the first time from vicinity of Chaldoran in the west Azerbaijan Province, Iran.



Figure 4 Habitat and type locality of *Darevskia raddei chaldoranensis* ssp. nov.

4. Conclusion

The taxonomic status and phylogenetic affinity of various species of *Darevskia* have been treated by some workers

(e. g., Darevsky, 1967; Eiselt *et al.*, 1993; Eiselt, 1995; Bobyn *et al.*, 1996; Murphy *et al.*, 1996, 2000; Arribas, 1997, 1999; Fu and Murphy, 1997; Schmidtler *et al.*, 2002; Arnold *et al.*, 2007). Arribas (1997), in his PhD dissertation, based on anatomical and morphological characteristics, proposed the generic name *Darevskia* for a group of small-sized taxa of lacertids, which previously belonged to the tribe Lacertini and had been early considered belonging to the inclusive genus *Lacerta* Linnaeus, 1758. These small lacertids mostly occur in northern and western regions of the Iranian Plateau, the Caucasus and Asiatic Turkey. Among the most important morphological characters of *Darevskia*, the following characters are mentioned (Arribas, 1997; Arnold *et al.*, 2007): the size ranging between 50–85 mm from snout to vent; rostral separated from frontonasal in most species; posteriorly, the parietal table contacting with outer edge of parietal scale; a single postnasal present; no contact often found between supranasal and anterior loreal; usually four upper labials being anterior to subocular which touches mouth; masseteric scale present; dorsal scales small and often smooth or very weakly keeled (but in *D. chlorogaster* and *D. praticola*, dorsal scales distinctly keeled); about 35–70 dorsal scales found in a transverse row at middle body; collar smooth or serrated; six longitudinal rows of ventral scales present; preanal scales usually large, anteriorly bordered by a single semicircle of smaller scales.

The genus *Darevskia* Arribas, 1997 encompasses about eight species in Iran as: *D. chlorogaster* (Boulenger, 1908), *D. defilippii* (Camerano, 1877), *D. mostoufii* (Baloutch, 1976), *D. praticola* (Eversmann, 1834), *D. steineri* (Eiselt, 1995), *D. valentini* (Boettger, 1892) and *D. raddei* (Boettger, 1892). Prior to this study, the latter species encompassed three distinct subspecies: *D. r. raddei* (Boettger, 1892) which occurs in some regions of the western Caspian Sea, as well as in some areas of East Azerbaijan and Ardabil Provinces (Eiselt *et al.*, 1993; Anderson, 1999; Rastegar-Pouyani *et al.*, 2007, 2008a, 2008b). *D. r. nairensis* (Darevsky, 1967) occurs in the northern and northwestern regions of Armenia, as well as in northeastern Turkey (Darevsky, 1967). *D. r. vanensis* (Eiselt *et al.*, 1993) distributes in some areas of extremely eastern Turkey, east of Lake Van (Eiselt *et al.*, 1993; Eiselt, 1995; Anderson, 1999; Rastegar-Pouyani *et al.*, 2007, 2008a).

Darevsky (1967) introduced a new subspecies of *D. raddei* from the northern and northwestern parts of the range. He named this new taxonomic entity as *D. r. nairensis* (Darevsky, 1967). It was different from the nominal subspecies (*D. r. raddei*) based on several distinguishing

characters pertaining to pholidosis as well as in color pattern (Darevsky, 1967).

Eiselt *et al.* (1993) reported another new subspecies of *D. raddei* from extremely southeastern Turkey, west of Lake Van. They named this new taxonomic entity as *D. r. vanensis* which is, more or less, distinguished from both *D. r. raddei* (Boettger, 1892) and *D. r. nairensis* (Darevsky, 1967) based on body size, pholidosis and color pattern (Eiselt *et al.*, 1993). In the same paper, Eiselt *et al.* (1993) introduced an undefined, intermediate form within *D. raddei*. This intermediary form distributes in the western areas (Sero, Khoy, Maku) of west Azerbaijan Province, northwestern Iran. It is geographically and morphologically intermediate between *D. r. raddei* in the east (occurring in Ardabil and East Azerbaijan Provinces as well as in southern Armenia) and *D. r. vanensis* in the west (occurring in the western and northwestern regions of Lake Van in extremely southeastern Turkey).

Based on the data given by Eiselt *et al.* (1993), the intermediary form of *D. raddei* differs significantly from the other three relevant subspecies, i. e., *D. r. raddei*, *D. r. vanensis* and *D. r. nairensis* which occur in northwestern Armenia as well as the eastern regions of the Black Sea.

As noted before, our specimens were collected in a place about 20 km southwest of Shut (near the road between Siah Cheshmeh and Shut) in Chaldoran area (39° 03' N, 44° 22' E), which is very close to Maku and within the range of the above-mentioned undefined and intermediary form reported by Eiselt *et al.* (1993). Based on the available evidences (i. e., geographic distribution, habitat and morphology), the comparison of our material with the data given by Eiselt *et al.* (1993) and Eiselt (1995) strongly supports the idea that our specimens fully correspond to the undefined and intermediary form reported by Eiselt *et al.* (1993).

Anderson (1999) commented on the findings of Eiselt *et al.* (1993) and Schmidtler *et al.* (1994), and tentatively considered *D. r. vanensis* occurring in northwestern Iran. Pending a comprehensive analysis (using enough material and employing all the available approaches), at the time being, we can not confirm Anderson's view (1999) and consider all populations of the intermediate form as belonging to our newly described subspecies (*D. r. chaldoranensis*).

Further studies, employing molecular markers, to compare and determine phylogenetic and biogeographic relationships of our new taxonomic entity (*D. r. chaldoranensis*) are now being carrying out and the relevant results will be published in a forthcoming paper.

Further field work and collection from the bordering

regions between northwestern Iran and southeastern Turkey would throw more light on exact taxonomic and biogeographic status of *Darevskia* species occurring in this region.

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